

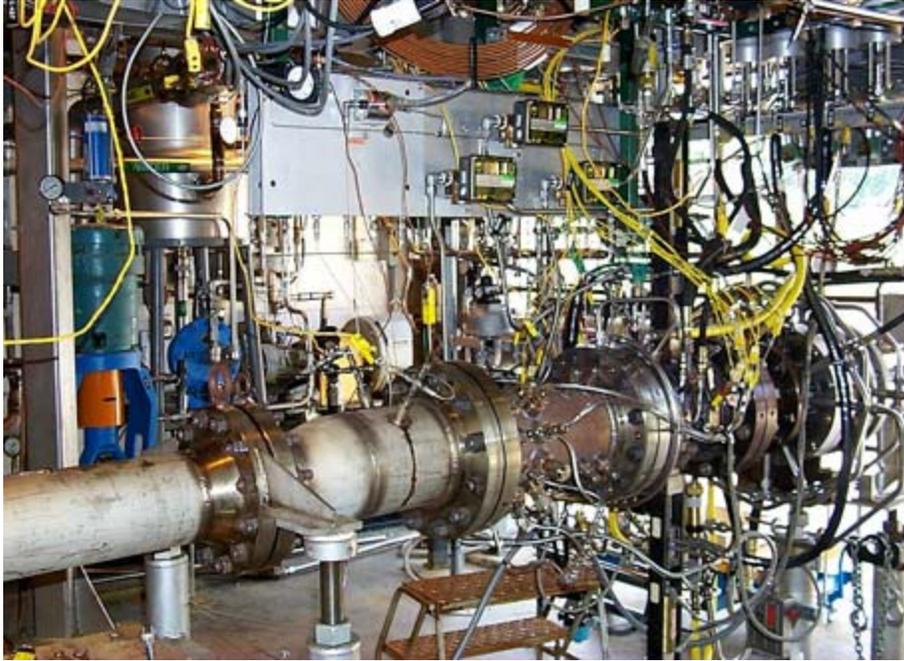
Fuel Flexible Gas Turbine Combustor Flametube Facility Upgraded

In fiscal year 2003, test cell 23 of the Research Combustion Laboratory (RCL 23) at the NASA Glenn Research Center was upgraded with the addition of gaseous hydrogen as a working propellant and the addition of a 450-psig air-supply system. Test flexibility was further enhanced by upgrades to the facility control systems. RCL 23 can now test with gaseous hydrogen flow rates up to 0.05 lbm/sec and jet fuel flow rates up to 0.62 lbm/sec. Research airflow rates up to 3 lbm/sec are possible with the 450-psig supply system over a range of inlet temperatures. Nonvitiated, heated air is supplied from a shell and tube heat exchanger. The maximum nonvitiated facility air temperature is 1100 °F at 1.5 lbm/sec. Research-section exhaust temperatures are limited to 3200 °F because of material and cooling capacity limits.

A variety of support systems are available depending on the research hardware configuration. Test section ignition can be provided via either a hydrogen air torch system or an electronic spark system. Emissions measurements are obtained with either pneumatically or electromechanically actuated gas sample probes, and the electromechanical system allows for radial measurements at a user-specified axial location for measurement of emissions profiles. Gas analysis data can be obtained for a variety of species, including carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO and NO_x), oxygen (O₂), unburnt hydrocarbons, and unburnt hydrogen.

Facility control is accomplished with a programmable logic control system. Facility operations have been upgraded to a system based on graphical user interface control screens. A data system is available for real-time acquisition and monitoring of both measurements in engineering units and performance calculations.

The upgrades have made RCL 23 a highly flexible facility for research into low-emissions gas turbine combustor concepts, and the flame tube configuration inherently allows for a variety of fuel nozzle configurations to be tested in a cost-effective manner. RCL 23 is poised to be a leading facility for developing modern low-emission fuel nozzles for use with jet fuel and alternative fuels.



Typical flametube installation for RCL 23.

Long description. Test section of RCL 23 showing all the wiring, pressure tubing, and gas analysis probes.

Find out more about this research:

Glenn's Research Testing Division at <http://www.grc.nasa.gov/WWW/RTD/>

Glenn's research facilities at <http://facilities.grc.nasa.gov/>

QSS Group, Inc., contacts: James E. Little, 216-433-3821,
James.E.Little@grc.nasa.gov; and Steve A. Nemets, 216-433-6652,
Steve.A.Nemets@grc.nasa.gov

Glenn contacts: Tim D. Smith, 216-977-7546, Timothy.D.Smith@nasa.gov; Bruce J. Frankenfeld, 216-433-6456, Bruce.J.Frankenfeld@nasa.gov; and Robert Tornabene, 216-433-3045, Robert.T.Tornabene@nasa.gov

Authors: James E. Little, Steve A. Nemets, Robert T. Tornabene, Timothy D. Smith, and Bruce J. Frankenfeld

Headquarters program office: OAT

Program/Projects: Propulsion and Power, LEAP